What is claimed is:

1. A method for quantifying the needs and costs of a network, comprising:

determining quantities of required network variables using closed-form mathematical expressions for network-wide expectation values for mean quantities of the network variables.

2. The method of claim 1, further comprising:

determining variations of a minimum number of required network variables using said mathematical expressions.

3. The method of claim 2, wherein the variance of the number of demands appearing on a link is determined using at least one of the following equations:

$$\sigma^2(W^o) \leq \langle W^o \rangle [1 - 1/\langle h \rangle];$$

$$\sigma (W_{B/E}) / \langle W_{B/E} \rangle \cong \sqrt{[\langle \delta \rangle_n \langle 1/\delta \rangle_n - 1] / 2} \ ;$$

$$\sigma_d(W^o) / \langle W^o \rangle = [2/\langle h \rangle][(\sigma(d)/\langle d \rangle] \ ;$$

wherein $\langle W^o \rangle$ depicts the expectation value of the number of demands carried on the link, $\langle h \rangle$ depicts the expectation value of the number of hops on the link, $\langle \delta \rangle$ depicts the average degree of nodes, and $\langle d \rangle$ depicts the mean number of demands terminating at a node.

4. The method of claim 2, wherein the variance of the ratio of terminated to through traffic is determined using the following equation:

$$\langle \rho' \rangle = 2/[1 + \langle h \rangle];$$

wherein $\langle h \rangle$ depicts the expectation value of a number of hops on the network.

5. The method of claim 1, wherein said network variables are variables selected from the group consisting of network elements, subsystems and components.

6. The method of claim 1, wherein a communication demand model and a network graph, defined by a set of nodes and a set of links, provide inputs for the mathematical expressions.

7. The method of claim 1, wherein the mathematical expressions require inputs selected from the group consisting of a number of network nodes, a number of links and a number of demands in said network.

8. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a local value of the number of demands appearing on a link or carried on a means of transmission.

9. The method of claim 8, wherein the number of demands is determined using the following equation:

$$\langle W^0 \rangle = \langle d \rangle \langle h \rangle / \langle \delta \rangle;$$

wherein $\langle h \rangle$ depicts the expectation value of the number of hops on the link, $\langle \delta \rangle$ depicts the average degree of nodes in the network, and $\langle d \rangle$ depicts the mean number of demands terminating at a node.

10. The method of claim 8, wherein said demands comprise at least one demand selected from the group consisting of uniform demands, random demands, and distance dependent demands.

11. The method of claim 8, wherein said means of transmission comprises an optical line system or a multi-wavelength optical line system.

12. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a mean number of hops.

13. The method of claim 12, wherein said mean number of hops is determined using the following equation:

$$\langle h \rangle \cong \sqrt{(N-2)/(\langle \delta \rangle - 1)} \quad ,$$

wherein N depicts a number of nodes in the network, and $\langle \delta \rangle$ depicts the average degree of the nodes.

14. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a global mean value or a local value of a number of transmission subsystems.

15. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a variance of the number of transmission subsystems.

16. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a global mean value and/or a variance of a number of demands present at a node or connected to a means of bandwidth management.

17. The method of claim 16, wherein said demands comprise at least one demand selected from the group consisting of uniform demands, random demands, and distance dependent demands.

18. The method of claim 16, wherein said means of bandwidth management comprises a means selected from the group consisting of an electronic cross-connect, an IP router, a multi-service platform, an optical cross-connect, an optical router, and an optical add/drop multiplexer.

19. The method of claim 16, wherein said means of bandwidth management comprises a combination of electronic and optical bandwidth management.

20. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a value of the number of demands present at a node or connected to a means of bandwidth management.

21. The method of claim 20, wherein the number of demands present at a node is determined using the following equation:

$$\langle P^{\kappa} \rangle = \langle d \rangle + \langle W^{o} \rangle (1 + \langle \kappa \rangle) \langle \delta \rangle;$$

wherein $\langle W^{o} \rangle$ depicts the expectation value of the number of demands carried on a link, $\langle \kappa \rangle$ depicts the extra capacity for restoration, $\langle \delta \rangle$ depicts the average degree of nodes in the network, and $\langle d \rangle$ depicts the mean number of demands terminating at a node.

22. The method of claim 20, wherein said demands comprise at least one demand selected from the group consisting of uniform demands, random demands, and distance dependent demands.

23. The method of claim 20, wherein said means of bandwidth management comprises a means selected from the group consisting of an electronic cross-connect, an IP router, a multi-service platform, an optical cross-connect, an optical router, and an optical add/drop multiplexer.

24. The method of claim 20, wherein said means of bandwidth management is a combination of electronic and optical bandwidth management.

25. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a global mean value or a local value of a number of bandwidth management subsystems.

26. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a variance of the number of bandwidth management subsystems.

27. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a global mean value of the extra capacity necessary for network survivability.

28. The method of claim 1, wherein the global mean value of extra capacity is determined using at least one of the following equations:

$$\langle\kappa\rangle \cong 2/\langle\delta\rangle;$$
$$\langle\kappa\rangle \cong 4\langle h\rangle/L;$$

wherein $\langle\delta\rangle$ depicts the average degree of nodes in the network and $\langle h\rangle$ depicts the mean number of hops.

29. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a local value of the extra capacity required on a link or means of transmission for network survivability

30. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a cost of transmission of demands across the network.

31. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a cost of bandwidth management of demands across the network.

32. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a ratio of cost of electronic and optical bandwidth management.

33. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a ratio of cost of transmission and bandwidth management.

34. The method of claim 1, wherein said mathematical expressions comprise equations for calculating a cost of the network.

35. The method of claim 1, wherein said network comprises a network selected from the group consisting of a two-dimensional-single-tier mesh network, a two-dimensional-multi-tier network, a multi-dimensional network, and a multi-dimensional-multi-tier network.

36. A computer-readable medium for storing a set of instructions, which when executed by a processor, perform a method comprising:

determining quantities of required network variables using closed-form mathematical expressions for network-wide expectation values for mean quantities of the network variables.

37. The computer readable medium of claim 36, wherein said method further comprises:

determining variations of a minimum number of required network variables using said mathematical expressions.

38. A computer program product loadable into a computer for quantifying the needs and costs of a network, the computer program product comprising software for performing the step of:

determining quantities of required network variables using closed-form mathematical expressions for network-wide expectation values for mean quantities of the network variables.